We claim:

1. A quantum computing method, comprising:

(A) constructing a dressing transformation V between a physical Hamiltonian $H$ and an ideal Hamiltonian $H^{ID}$, wherein

said physical Hamiltonian $H$ describes a physical quantum computer that comprises a plurality of qubits, including interactions between said plurality of qubits and an error source,

said ideal Hamiltonian $H^{ID}$ describes a universal quantum computer that corresponds to said physical quantum computer,

and, for a dressed state $|\psi\rangle$ of said physical quantum computer, said dressing transformation V has the property that

$$|\psi\rangle = V^{\dagger}|\psi^{ID}\rangle$$

where

$|\psi^{ID}\rangle$ is an undressed state in the universal quantum computer that corresponds to the given dressed state $|\psi\rangle$ of said physical quantum computer, and

$V^{\dagger}$ is the Hermitian conjugate of said dressing transformation V;

(B) initializing each qubit in said plurality of qubits to a known state;

(C) performing a quantum calculation using said plurality of qubits; and

(D) measuring said plurality of qubits.

2. The method of claim 1 wherein said physical Hamiltonian $H$ is determined by characterizing said physical quantum computer.

3. The method of claim 2 wherein said characterizing said physical quantum computer comprises using quantum process tomography.

4. The method of claim 1 wherein said dressed state $|\psi\rangle$ of said physical quantum computer comprises the state of a qubit in said plurality of qubits and wherein said state of said qubit includes a basis state that represents interactions between a first basis state or a second basis state of said qubit and a continuum of basis states of said qubit.

5. The method of claim 1 wherein said undressed state $|\psi^{ID}\rangle$ of said universal quantum computer comprises the state of a qubit in said plurality of qubits and wherein said state of

said qubit does not include a basis state that represents interactions between a first basis state or a second basis state of said qubit and a continuum of basis states of said qubit.

6. The quantum computing method of claim 1 wherein said initializing comprises placing each qubit in said plurality of qubits in a known dressed state.

7. The quantum computing method of claim 1 wherein said performing said quantum calculation comprises applying a plurality of quantum gates to said physical quantum computer.

8. The quantum computing method of claim 7 wherein a quantum gate in said plurality of quantum gates is converted from an undressed basis to a dressed basis by application of said dressing transformation prior to application of said quantum gate to said physical quantum computer.

9. The quantum computing method of claim 1 wherein said dressing transformation has the property that $H = V^{\dagger} H^{ID} V$, where $V^{\dagger}$ is the Hermitian conjugate of said dressing transformation V.

10. The quantum computing method of claim 1 wherein said dressing transformation is separable with respect to said plurality of qubits.

11. The quantum computing method of claim 10 wherein said dressing transformation V has the property

$$H_{\alpha} = V^{\dagger} H^{ID}{}_{\alpha} V$$

where $\alpha$ is an index to corresponding terms in H and $H^{ID}$.

12. The quantum computing method of claim 1 wherein said dressing transformation is non-separable with respect to said plurality of qubits.

13. The quantum computing method of claim 1 wherein said measuring said plurality of qubits in said dressed basis comprises:

measuring said plurality of qubits in an undressed basis to form a result; and applying said dressing transformation to said result using a post-processing method.

14. The method of claim 1 wherein said initializing comprises placing one or more qubits in said plurality of qubits in a pure fiducial state that is basis independent with respect to both a dressed state and an undressed state.

15. The method of claim 14 wherein said one or more qubits are current biased Josephson junctions and said pure fiducial state that is basis independent with respect to the dressed state and the undressed state is $\psi_0$, where $\psi_0 = |1\rangle$ and $\psi_0 = |1^{ID}\rangle$.

16. The method of claim 1 wherein said initializing each qubit in said plurality of qubits comprises relaxing one or more of said plurality of qubits to a pure undressed ground state that is basis independent with respect to both a dressed state and an undressed state.

17. The method of claim 15 wherein said relaxing comprises cooling said one or more qubits for a sufficiently long time to fully populate said pure undressed ground state.

18. The method of claim 1 wherein

said initializing each qubit in said plurality of qubits comprises relaxing said plurality of qubits to an undressed ground state that does not have a known corresponding dressed state; and

said measuring includes applying said dressing transformation to said plurality of qubits.

19. The method of claim 18 wherein said plurality of qubits are electron-spin coupled by Heisenberg exchange interactions.

20. The method of claim 19 wherein said plurality of qubits comprise quantum dots or donor atoms in silicon arrays.

21. The method of claim 1 wherein said initializing each qubit in said plurality of qubits comprises relaxing one or more qubits in said plurality of qubits to an undressed ground state that has a known corresponding dressed state.

22. The method of claim 21 wherein a qubit in said one or more qubits is a current biased Josephson junction and said initializing comprises setting said qubit to the ground state $\psi_g$, where $\psi_g$, when expressed in bases selected from an undressed state, is $|0^{ID}\rangle$, and where $\psi_g$, when expressed in bases selected from the dressed state, is $\cos(\varphi)\,|0\rangle - \sin(\varphi)\,|2\rangle$, where $\varphi$ is a representation of the interaction of the $|0\rangle$ and $|1\rangle$ basis states with higher basis states of the current biased Josephson junction.

23. The method of claim 1 wherein

said initializing each qubit in said plurality of qubits comprises relaxing said plurality of qubits to an undressed ground state that does not have a known corresponding dressed state; and

applying said dressing transformation to each qubit in said plurality of qubits while it is in the undressed ground state thereby causing the qubit to adopt a quantum state $\psi$ that, when expressed in terms of the dressed basis, is pure.

24. The method of claim 23 wherein said plurality of qubits are characterized by a Heisenberg exchange interaction.

25. The method of claim 1, wherein the steps of initializing, performing a quantum calculation, and measuring a plurality of qubits, are performed after constructing a dressing transformation.

26. The method of claim 1, wherein the steps of initializing, performing a quantum calculation, and measuring a plurality of qubits, are performed before constructing a dressing transformation.

27. A quantum computing method, comprising:

providing a dressing transformation for a quantum computing system;

identifying a dressed Hamiltonian;

initializing the quantum computing system in a known state;

applying the dressed Hamiltonian to the quantum computing system;

performing a readout on the quantum computing system to yield readout information; and

applying the dressing transformation to undress the readout information.

28. The method of claim 27, wherein the known state is a pure state in a basis selected from the group consisting of a dressed basis, an undressed basis, and both the dressed and undressed basis.

29. A quantum computing method, comprising;

providing an ideal Hamiltonian set that is known to be universal for quantum computing; and

providing a Hamiltonian set for a physical system;

computing a dressing transformation between the ideal Hamiltonian set and the Hamiltonian set for a physical system; and

determining the dressed states of the physical system, wherein the dressed states of the physical system and the Hamiltonian set for a physical system quantum computation using the Hamiltonian set is universal.